FOREST PEST CONDITIONS IN WISCONSIN

ANNUAL REPORT 1992

DEPARTMENT OF NATURAL RESOURCES
BOX 7921
MADISON, WISCONSIN 53707

FOREST PEST CONDITIONS IN WISCONSIN ANNUAL REPORT - 1992

Compiled and Edited by Allen J. Prey,
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DEPARTMENT OF NATURAL RESOURCES
Division of Resource Management
Bureau of Forestry

ACKNOWLEDGEMENTS

This record of the activities of forest pests and other destructive agents of growing trees in Wisconsin's forest nurseries, plantations, and natural timber areas was made possible by the dedicated work of pest management personnel in each district and at the Forest Pest Management Laboratory in Madison. Department of Natural Resources foresters, other Department field personnel, cooperators in other public agencies and private forest industry contributed valuable assistance in monitoring the forest lands in all classes of forest ownership.

Preparation of this Annual Report was a result of a team effort involving Andrea Diss, William Kearby, Todd Lanigan, and Shane Weber, DNR District Pest Specialists who submitted district reports. Jane Cummings Carlson and Dave Hall, Forest Pest Unit, Madison, consolidated the district reports and wrote the final draft. Mark Guthmiller, Limited Term Employe, prepared the computer-generated and hand-drawn maps, and Katherine Severson, Southern District Program Services, completed the word processing. Final printing was done by the DNR Bureau of Program Services.

Allen J. Prey
Supervisor, Forest Pest Management
June 30, 1993

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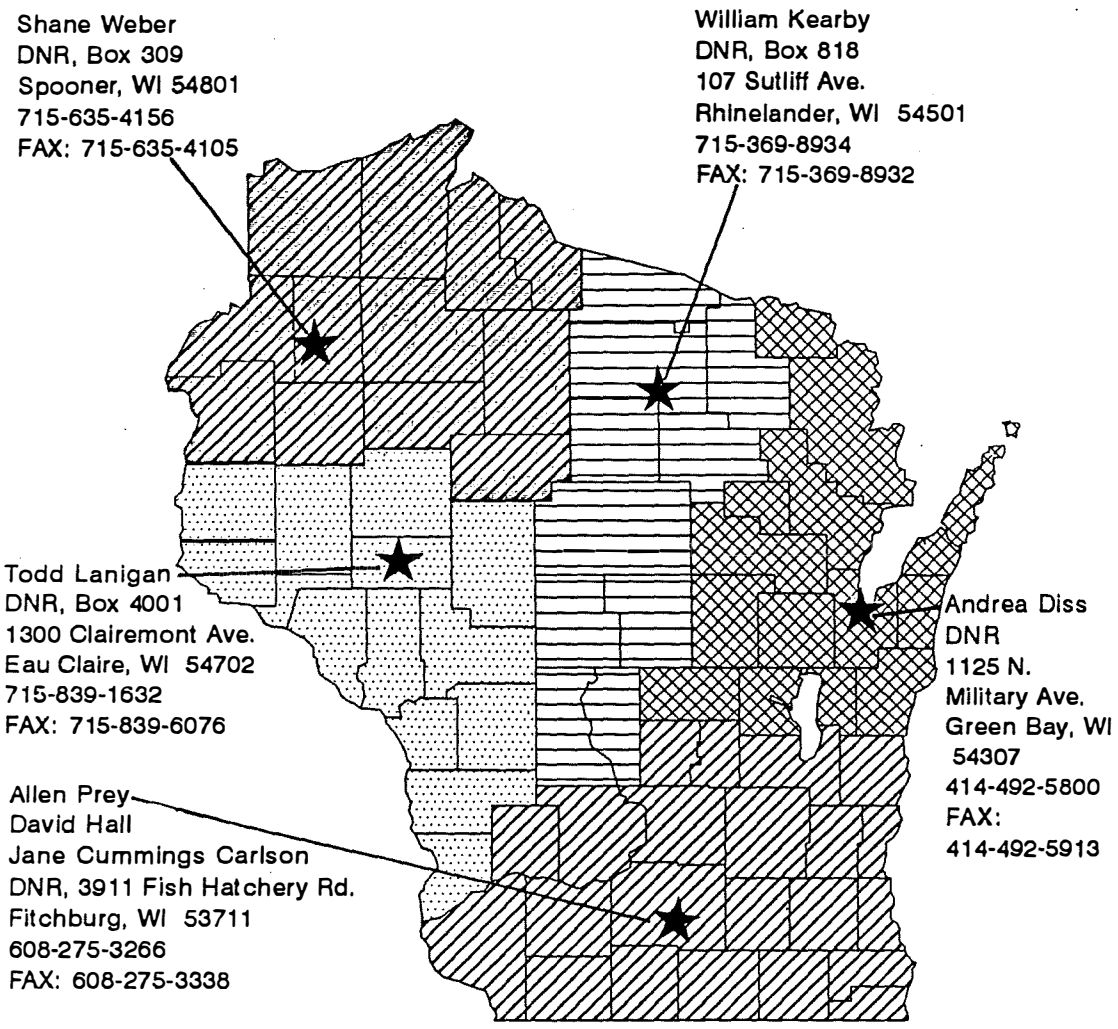

Figure 1. Station locations of Wisconsin Department of Natural Resources District Entomologists and Forest Pest Unit Personnel.

DEPARTMENT OF NATURAL RESOURCES
Forest Pest Management Personnel - December 31, 1992

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INTRODUCTION

This report lists the major insect, disease, and other health problems reported on forest land in Wisconsin in 1992. While the report does not list all the insect and disease problems that occurred on forest land, it does highlight major or noteworthy insect infestations and disease occurrences including abiotic damage to trees.

Two district pest specialists were hired in 1992; Todd Lanigan in Eau Claire in the Western District, and Andrea Diss in Green Bay in the Lake Michigan District.

In 1992, insect and disease detection surveys were conducted on 3.1 million acres and evaluation surveys on 4.8 million acres. In addition, Wisconsin DNR district pest specialists continued to teach integrated pest management principles to Wisconsin DNR foresters, industrial foresters, and private woodland owners. District forest pest specialists and forest pest unit staff provided a wide variety of programs and information on forest pests in 1992.

The following activities were accomplished by the district pest specialists and the forest pest unit staff in the Bureau of Forestry.

OUTREACH

A program for woodland owners on pest management of oak and pine pests was produced with cooperation from University of Wisconsin-Extension. The program emphasized nonchemical procedures to reduce the impact of insects and diseases and was presented in Fond du Lac on January 25; in Madison on February 29 and in Eau Claire on March 14.

Presentations on IPM practices, and updates on specific pest problems were given to the following groups: Forestry Tech. Class at Fox Valley Tech., Walnut Council, Forest Insect and Disease Class at UW-Stevens Point, DNR Naturalists from State Parks, Wisconsin Christmas Tree Growers Association, general public concerned with Gypsy Moth and Forest Tent Caterpillar in Marinette County, Northern Conservation Association, Friends of the Park Environmental Organization, Vocational Agriculture Teachers at Trees for Tomorrow, DNR Board, Governor's Council on Forestry, Forest County Administrators, Spooner Kiwanis Club, general public at the Pattison Park open house, general public at the Spooner nursing home, USFS staff on the Chequamegon National Forest, general public through radio interviews and TV-13 out of Eau Claire, foresters in eastern Wisconsin attending a Crop Reduction Program field tour, a plant pathology class from UW-Madison, and 8th-graders in the Black River Falls area.

The forest pest management exhibit showcasing the gypsy moth, oak wilt, and forest tent caterpillar was displayed at various meetings including the Woodland Owners Association annual meeting, the Wisconsin Christmas Tree Growers meeting, and at presentations listed previously. The fire prevention exhibit was also staffed by pest management personnel and displayed in Eau Claire.

A handout was written on managing storm damaged trees for people coping with the damage of the Wautoma tornado.

TRAINING

Training on gypsy moth identification and management was given to Southern District foresters and Gypsy Moth trappers. The program on Compartmentalization of Decay in Trees was presented to the new DNR foresters and other interested parties. Oak Wilt Management options were presented to Southern District foresters. Forest pest identification training was given to the field crew conducting forest health surveys for the Bureau of Air Management, the new DNR foresters, and to U.S. Forest Service personnel in north-central Wisconsin. A training session on the management of *Phellinus pini* rot of white pine was conducted for the foresters on the Menominee Indian Reservation.

Some or all of the forest pest specialists and forest pest staff also attended numerous training sessions including: CPR training, a

conference entitled "Managing for Biodiversity," the North Central Forest Pest Workshop, Androc pesticide update, Endangered Resource Training, Forest Health Monitoring Techniques, and the Maple crown rating for the North American Maple Project.

MEETINGS

The entire pest management unit attended the USFS State Cooperators Meeting on March 3 and 4.

The Forest Pest Management Unit attended the North Central Forest Pest Workshop hosted by Michigan DNR at Gull Lake on October 7-9.

A Forest Pest Unit staff member attended the National Gypsy Moth Review Meeting at Indianapolis, Indiana and the American Phytopathological Society annual meeting in Portland, Oregon. The Midcontinental Nursery Pathologists Meeting was hosted by the Forest Pest Unit.

REPORTS AND PAPERS

The following reports were completed: Accomplishment report, Forest Health Report, Forest Pest Situation Report, Annual Report of Forest Pest Conditions, Northwest Wisconsin Hardwood Report, and the Aspen Potential for Northwest Wisconsin.

A paper titled "Survey of Black Walnut Canker in Plantations in Five Central States" was published in the Norther Journal of Applied Forestry. A paper entitled "Ash Crown Conditions and the Incidence of Ash Yellows and Other Insects and Diseases in Illinois, Iowa, Missouri, and Wisconsin" was published in Plant Disease.

A paper titled "Fifty Years of Survey and Control of Oak Wilt in Wisconsin USA-A Review" was presented at the recent studies on Oak Decline International Congress, Selva di Fasano (Brindisi), Italy, September 13-18, 1992. There was also a paper titled "Epidemiology of Oak Wilt Outside Texas" which was presented at the National Oak Wilt Symposium held in Austin, Texas on June 23-25, 1992.

PESTICIDE MANAGEMENT

The publication, Herbicides for Forest Management was updated and published. The pesticide tables and management recommendations for Wisconsin's forest tree nurseries was updated.

An information sheet on Herbicides for Tree Plantations on CRP lands was updated, printed and mailed out.

The second annual Southern Wisconsin Forest Vegetation Management Field Tour in Outagamie and Waupaca counties was conducted on July 29.

IPM PROJECTS

An effort to produce silvicultural prescriptions for oak stands threatened by the gypsy moth in the Lake States was initiated with the approval of a Focus fund project.

GYPSY MOTH

DNR cooperated with DATCP, USFS and USDA-APHIS in an eradication program. DNR mass trapped 3,840 acres. See text.

Pest Management staff participated in a cooperative effort with DATCP, USFS, APHIS, and UW to resolve the conflicts among agencies and produce a statewide strategic plan for managing the gypsy moth in Wisconsin.

SURVEYS

Numerous surveys were conducted. Some of those include: an oak and pine mortality aerial survey, jack pine budworm and pine tussock moth surveys in northwest and western Wisconsin, a survey of butternut to determine the incidence and severity of butternut canker in 32 counties, forest tent caterpillar aerial and ground surveys, and a survey to determine the incidence of oak wilt in Marinette County.

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ASH

Ash Yellows - Mycoplasma Like Organism (MLO)

No new locations of this disease were observed in 1992. The current distribution of ash yellows is illustrated in Figure 2.

Ash Decline - Unknown

One verified case of decline was observed in Brown County. Foresters in Manitowoc County, northeast Wisconsin, reported sudden death of ash but the cause was unknown.

Mountain Ash Sawfly - *Pristophora geniculata* (Hartig)

This insect was present in low numbers in northwestern Wisconsin.

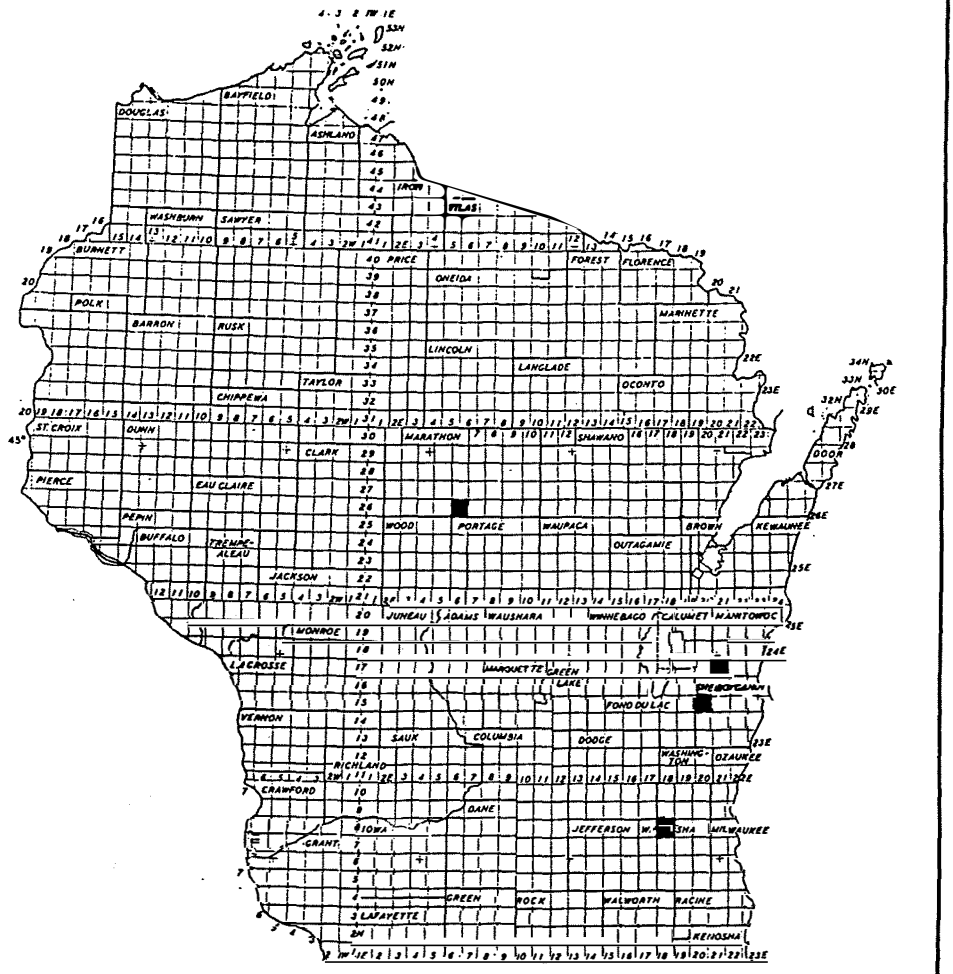

Figure 2. Known township locations of Ash Yellows in Wisconsin-1992.

Ash Flowergall mite - *Aceria fraxiniflora*

Galls were present on most of the ash in Green Bay, eastern Wisconsin, and this has caused a number of complaints from the public. City foresters and the local extension agent are considering testing a number of control methods to decrease the visible damage.

ASPEN

Aspen Bronzing
- Unknown

Symptoms of aspen bronzing continued to appear at previously know locations of this disease. New locations were observed in Barron (T35N, R14W), Sawyer (T37N, R9W), and Oneida counties (T38N, R7E, Sec. 11) (Figure 3). The new location in Oneida County occurred in 3 mature big-toothed aspens along Highway 47, southeast of Woodruff. Seventy-five percent of the foliage on the 3 affected trees had symptoms of bronzing in August.

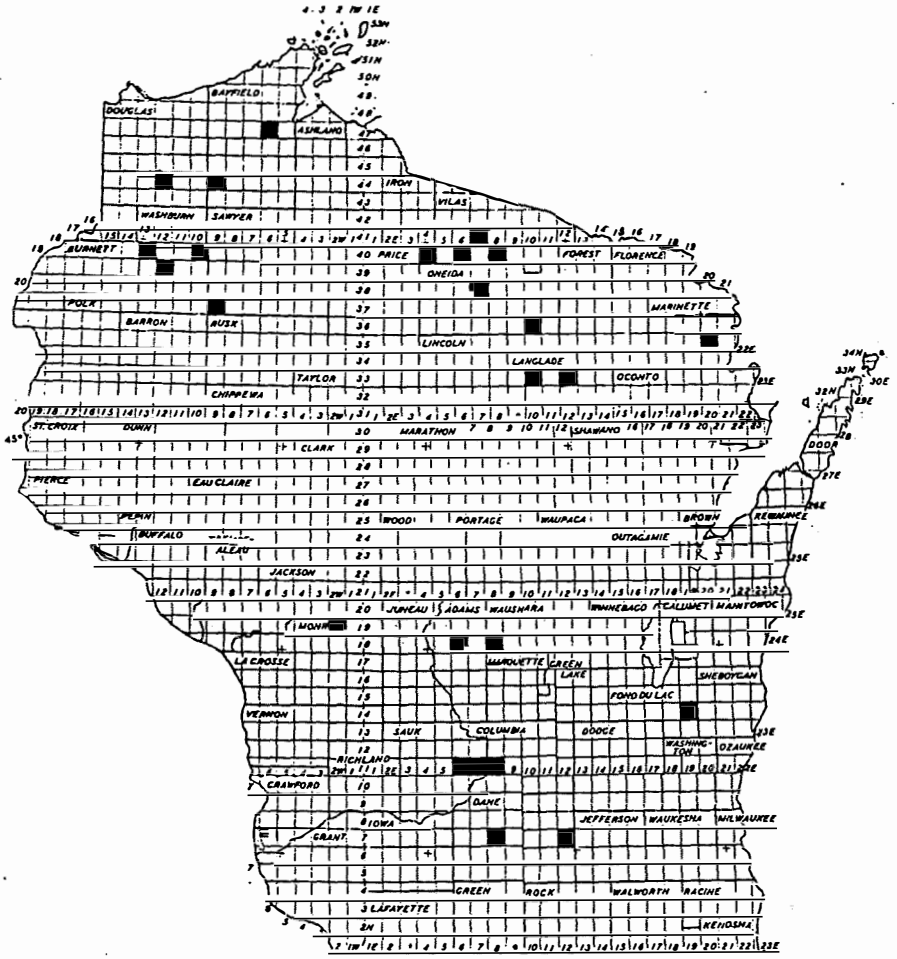

Figure 3. Known township locations of Aspen Bronzing - 1992.

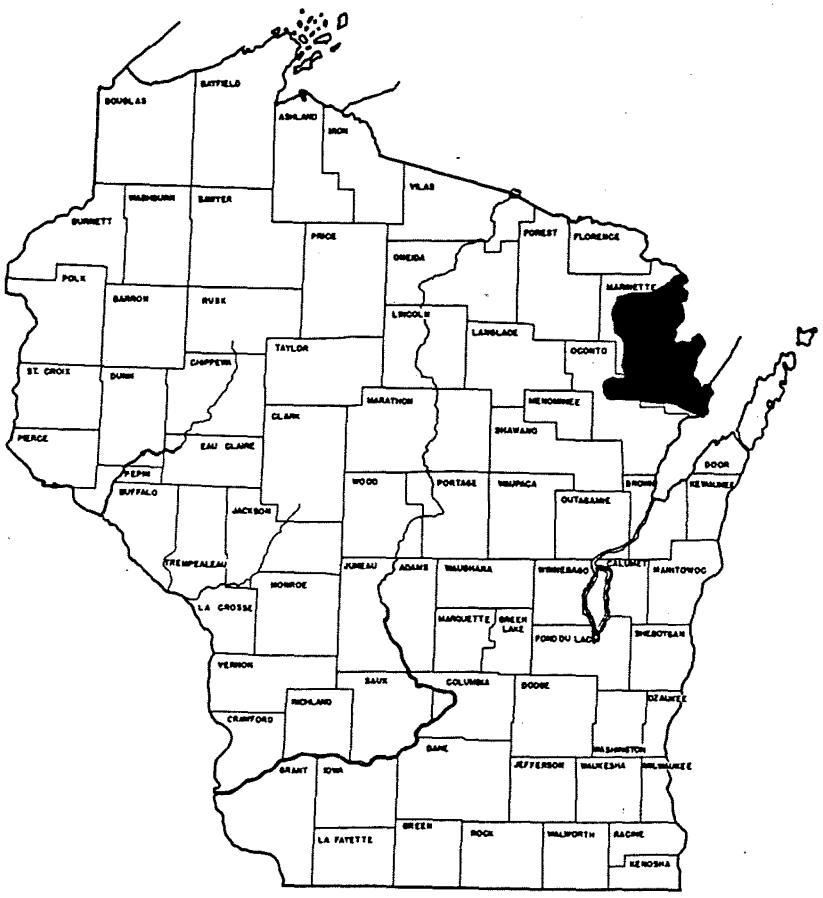

Figure 4. Areas of light to heavy defoliation by the Forest Tent Caterpillar - 1992.

Forest Tent Caterpillar - *Malacosoma disstria* (Hubner)

The outbreak in northeastern Wisconsin was believed to have collapsed in 1991. However, after a mild winter, 1992 saw an explosion in the extent of defoliation throughout Marinette and northern Oconto counties. Aerial surveys (Figure 4) indicated almost all aspen acreage in this area experienced some defoliation with numerous pockets of heavy defoliation occurring in aspen and oak types. About 200,000 acres in Marinette and 8,000 acres in Oconto County suffered moderate to heavy defoliation (Figures 5, 6).

An egg mass survey conducted in January and February, 1993 indicates population levels will be high in 1993 in southeastern Marinette County and northern Oconto County. All sites sampled in Peshtigo, Porterfield, and Lake townships in Marinette County and Brazeau Township in Oconto County had large numbers of egg masses, and viability of the eggs was 95% or better. Heavy defoliation should be expected on aspen and oak in these areas.

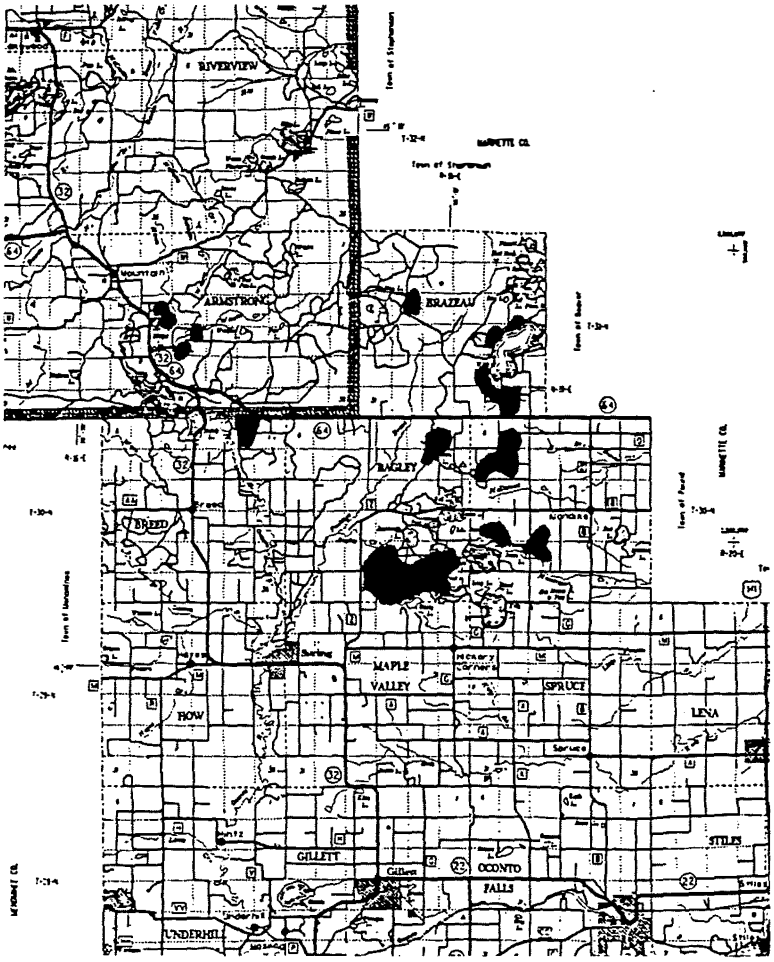

Figure 5. Area of defoliation in Oconto County caused by the forest tent caterpillar - 1992.

In Marinette County some owners of wooded residential lots are organizing an aerial spray project to protect their shade trees. They are receiving technical help from the DNR forest entomologist.

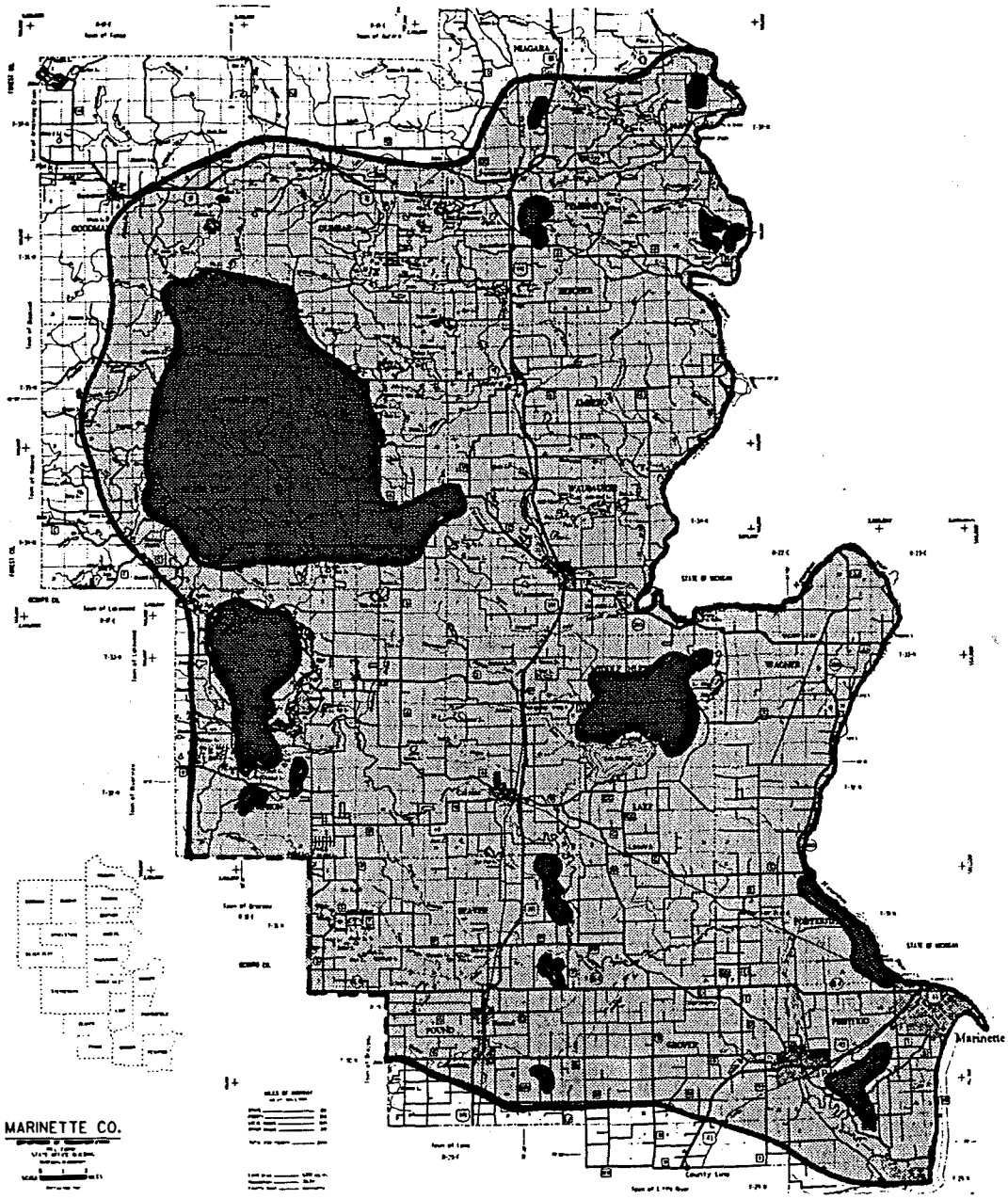

Figure 6. Area of defoliation in Marinette County, caused by the forest tent caterpillar - 1992.

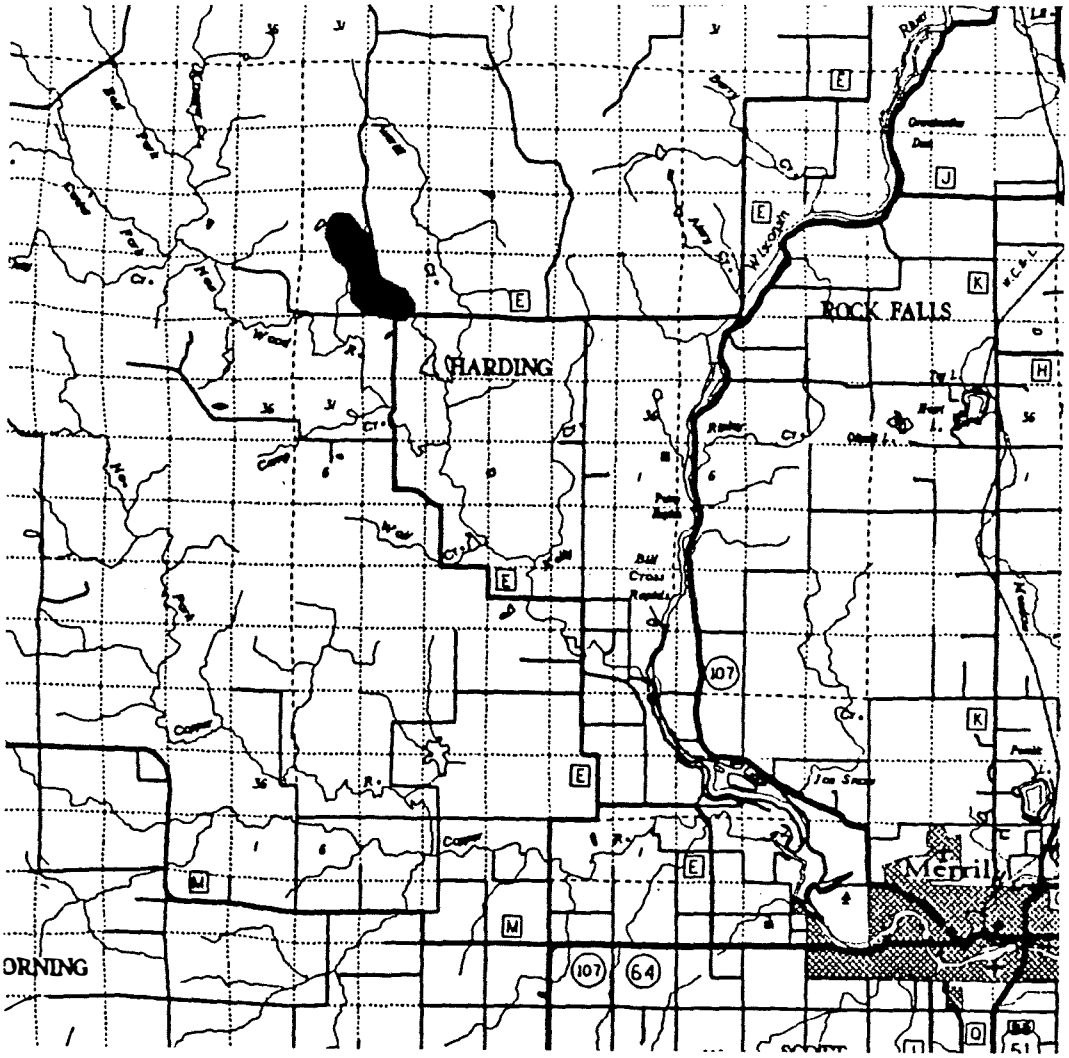

Figure 7. Area of defoliation in Lincoln County caused by the large aspen tortrix - 1992.

Large Aspen Tortrix - *Choristoneura conflictana* (Walker)

Two outbreaks were observed in north-central Wisconsin; one in Lincoln County and one in Oneida County (Figures 7, 8). These outbreaks caused heavy defoliation of aspen. Populations of the large aspen tortrix decreased from 1991 levels in northwestern Wisconsin; no significant defoliation was observed.

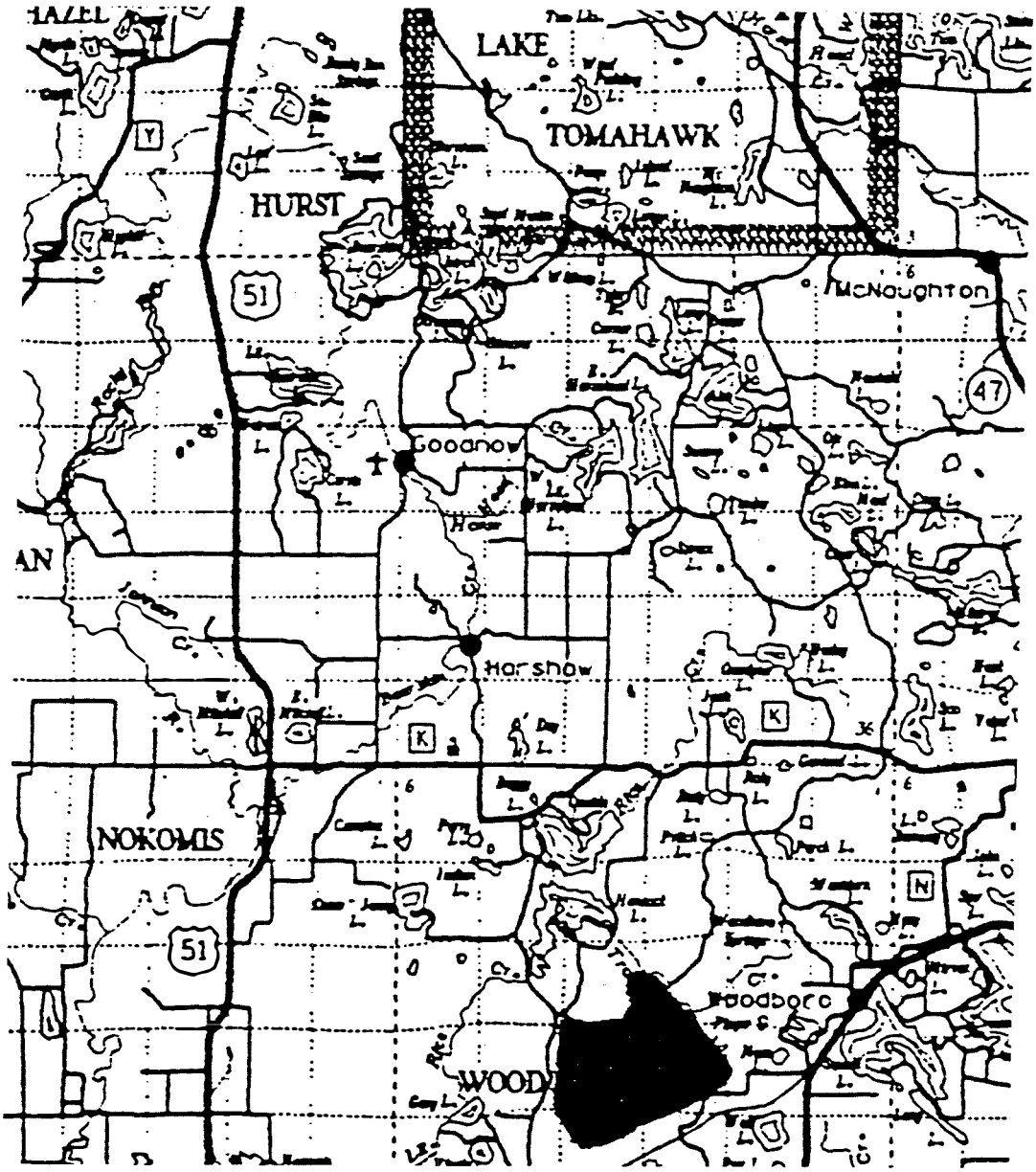

Figure 8. Area of defoliation in Oneida County caused by the large aspen tortrix - 1992.

BALSAM FIR

Spruce Budworm - *Choristoneura fumiferana* (Clemens)

No defoliation of balsam fir by the spruce budworm was observed in northwestern Wisconsin.

Balsam Gall Midge - *Paradiplosis tumifex* (Gagne)

In Brown County, eastern Wisconsin, 15-20% of a Christmas tree growers' balsam fir trees were infested with balsam gall midge. In northwestern Wisconsin, populations were lower than in 1991, and very little significant needle drop was observed in balsam fir Christmas or wild balsam fir. Balsam gall midge was also observed in Vilas, Oneida, Lincoln, Langlade and Marathon counties. Injury was restricted to individual trees and small areas of Christmas trees. Some trees had 25% of their new foliage infested.

Balsam Fir - Fern Rust - *Uredinopsis americana* P. Syd. & Syd.

There was one report of rust from Brown Co, east-central Wisconsin, and several reports from counties in north-central Wisconsin. Injury was limited to trees near marshy areas with abundant ferns. Needle loss was light.

BASSWOOD

Introduced Basswood Thrips - *Thrips calcaratus* Uzel

There was no known defoliation of basswood by the introduced basswood thrips anywhere in Wisconsin in 1992.

Basswood Leafroller Complex

Approximately 15,000 acres of basswood in Rusk County had moderate to heavy defoliation by the basswood leafroller complex.

BIRCH

White Birch Dieback and Mortality: Drought

A 3-year (1990-1992) survey was conducted on the Oneida County forest (north-central Wisconsin) to determine the effect of the 1988 and 1989 drought on the health of white birch. Nine stands were evaluated by collecting data on dieback of white birch within numerous 10-basal area factor plots located along a predetermined cruise course. Healthy white birch constituted 73, 88 and 79 percent of the white birch observed in 1990, 1991 and 1992, respectively. Dead white birch constituted 4, 5 and 15 percent of the white birch observed in 1990, 1991 and 1992, respectively. Some of the trees that were experiencing advanced dieback in 1990, died by 1992, yet overall, white birch remains an important component of these stands and will probably survive until the next major stress or rotation age.

Birch Leafminer - *Fenusa pusilla* (Lepeletier)

Leafmining by this insect was not as severe in 1992 as was observed during the dry years of 1988 and 1989. Scattered road side and ornamental birch were infested in northwestern and north-central Wisconsin. Moderate defoliation of forest edge and open grown trees was observed in Oneida and Langlade counties.

Bronze Birch Borer - *Agrilus anxius* Gory

Mortality caused by the bronze birch borer decreased from 1988-1991 levels. Mortality was light throughout northern Wisconsin.

BUTTERNUT

Butternut Canker - *Sirrococcus clavigignenti - juglandacearum* Nair, Kostichka and Kuntz

A statewide survey for butternut canker was conducted with the following objectives: determine the incidence and severity of butternut canker by various size classes in known areas of infestation and previously unreported areas; determine whether or not butternut is reproducing in seed or stump sprout form. Eighty-two locations were visited and at each location, all butternuts within a one-acre plot were evaluated for disease incidence and severity; the presence and health of butternut reproduction was also noted. At each site, an additional survey was conducted by walking the property for 1 hour or until 25 butternuts were observed and evaluated.

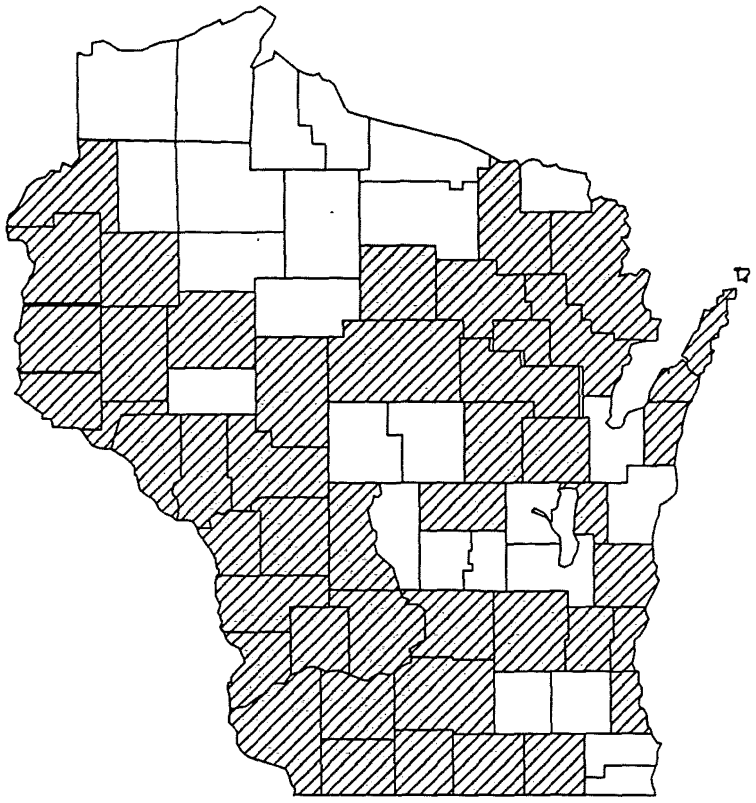

Figure 9. Known county distribution of butternut canker - 1992.

A total of 1,394 butternuts were evaluated during 1992. Twenty-seven percent of the trees surveyed were dead. Ninety-one percent of the live trees were cankered. Six percent of the trees had basal sprouts; 65 percent of the sprout clumps were cankered. Eighteen percent of the live trees were less than 2 inches in diameter; 75 percent of these small trees were cankered. Apparently resistant individuals were observed but rare. Cankered butternuts were observed in 18 previously unreported counties; confirmation via isolation of *S. clavigigneti-juglandacearum* was obtained for 15 of the 18 counties. Butternut canker is now widely distributed throughout Wisconsin (Figure 9). Regeneration was encountered only occasionally and primarily in disturbed areas such as roadways, pastured fields, trail edges, heavily logged woods and pond shorelines. Efforts are underway to develop management guidelines for butternut that will include conservation practices for healthy butternut and regeneration guidelines to enhance the potential of butternut as a component within a stand.

CHERRY

Eastern Tent Caterpillar - *Malacosoma americanum* (Fabricius)

The larvae emerged in Oconto Falls, Oconto County on May 2 and 1-inch tents were observed on May 4. Heavy defoliation of roadside *Prunus* spp. occurred in Marinette and northern Oconto counties. In northwestern Wisconsin, defoliation was scattered and reduced from 1991 levels. Populations continued at moderate levels in southern Wisconsin with locally heavy pockets of defoliation.

Uglynest Caterpillar - *Archips cerasivorana* (Fitch)

This normally obscure defoliator increased to noticeable levels in Washburn and Burnett counties where it defoliated black cherry.

AMERICAN CHESTNUT

Chestnut Blight - *Cryphonectria parasitica* (Murr.) Barr

Survey and disease management efforts were concentrated on a 60-acre American chestnut stand in LaCrosse County where chestnut blight was first observed in 1987. This stand has approximately 2,500 American chestnuts >2 inches in diameter. Twenty-three trees are currently cankered and a total of 57 cankers are present in the stand. In June, 54 cankers were inoculated with the hypovirulent form of the virulent isolate present in the LaCrosse stand. Inoculations were conducted by removing the bark from the face and margins of the cankers then placing a slurry of hypovirulent *C. parasitica* into small holes along the margin of the cankers. The holes were made with a leather punch. In October, all inoculated cankers were evaluated for the presence of callus tissue. Callus tissue has formed on all inoculated cankers to varying degrees. This stand will be resurveyed during the winter of 1992-'93 for the presence of new cankers. Inoculation of new cankers with the hypovirulent strain is planned for 1993.

CHRISTMAS TREES

Cyclaneusma Needlecast - *Cyclaneusma minus* (Butin) DiCosmo, Peredo and Minter

This needlecast disease continues to be present throughout Scotch pine Christmas tree plantations. Moderate levels of needlecasting was observed in two Christmas tree plantations in Marathon County.

Balsam Fir - Fern Rust - *Uredinopsis americana* P. Syd. & Syd.

See section on Balsam Fir.

Spruce Needle Rust - *Chrysomyxa* sp.

Approximately 2,000 Colorado Blue Spruce, 12-15 inches in height were lightly defoliated by this rust in Oneida County. Incidence in northwestern Wisconsin was light.

LARCH

Larch Top Dieback and Mortality - Cold Injury

Top dieback and mortality was observed scattered throughout a plantation of Japanese and Japanese/European hybrid larch on the Coulee Experimental Forest, LaCrosse County, western Wisconsin. The trees were planted in 1984. Most of the affected trees had long cracks in the bark and pitch oozing from the cracks. *Sphaeropsis* sp. was observed fruiting along the margins of some of the cankers. Parts of Wisconsin experienced frost in late May and late June. The trees may have been injured by one of these frosts and subsequently infected by *Sphaeropsis* sp.

A European larch plantation in Lorain Township (Section 32, T37N, R15W), Polk County, had very similar symptoms approximately 10 years ago.

Larch Needlecast - *Mycosphaerella laricina* (Hartig) Neg.

This disease was severe on a 10-acre planting of European larch in Lorain Township (Section 32, T37N, R15W), Polk County. Severe defoliation occurred on 80 percent or more of the living trees.

Larch Sawfly - *Pristiphora erichsonii* (Hartig)

Populations were generally very light statewide. A very heavy population was reported on tamarack in Fond du Lac County.

MAPLE

Sugar Maple Decline Survey - North American Maple Decline Project

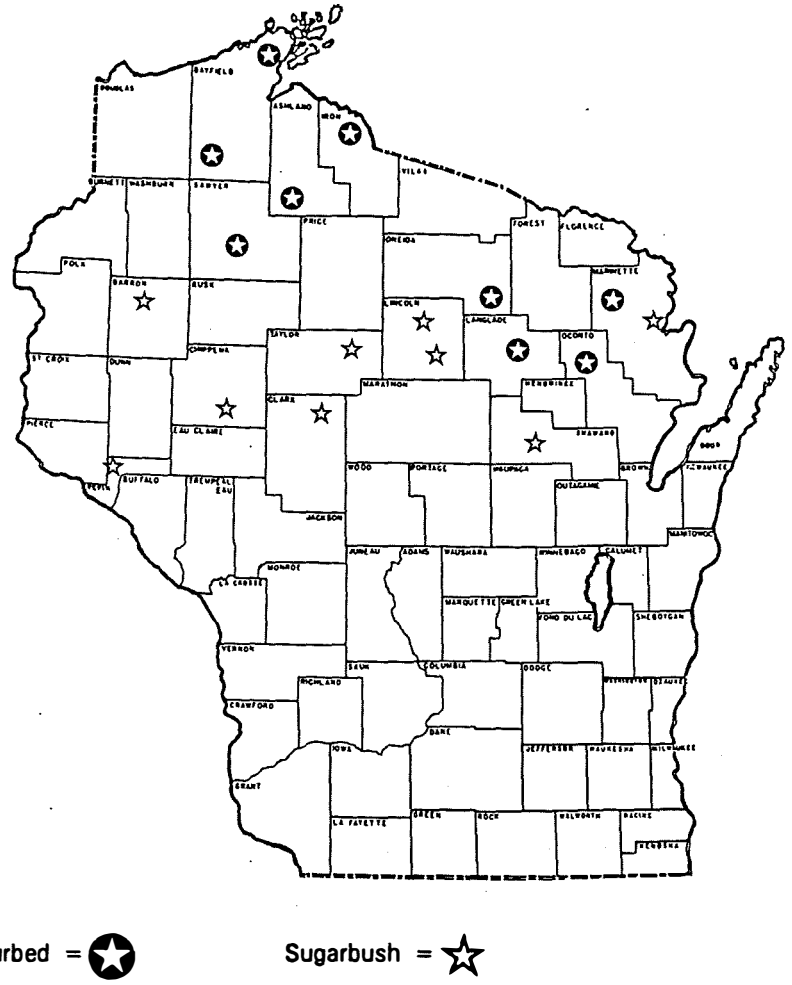

Figure 10. Location of plots in North American Sugar Maple Decline Project.

Wisconsin continued to participate in the North American Maple Project, administered by the U.S. Forest Service and Canadian Forestry Service. Eighteen plots, each plot a cluster of 5, 20 x 20 meter plots, were established in Wisconsin in 1988, 9 in stands being tapped for maple syrup and 9 in forest stands not tapped for maple syrup (Figure 10). Data on tree vigor, dieback, discoloration, dwarfing, and crown transparency have been collected. The following results were taken from Cymbala, R.J., and allen, D.C. 1993. Temporal Change in Sugar Maple Crown condition in Wisconsin from 1988 - 1992, State University of New York Research Foundation, College of Environmental Science and Forestry, Syracuse, New York. Analysis of average cluster dieback ratings based upon a multiple comparison procedure, revealed no significant difference between management categories for each of five years. Analysis of average cluster transparency ratings found no significant annual differences between management categories. Over time, the increase in average cluster transparency between 1988-1989 (8.0 percent) and decrease between 1990-1991 (-9.2 percent) are statistically significant. In spite of the fluctuations between years, the difference between 1988 and 1992 is -0.6 percent and is not

significant. Two years following the severe drought in 1988, the principal effect on sugar maple crowns appears to be increased transparency.

Saddled Prominent - *Heterocampa guttivitta* (Walker)

Approximately 480 acres of heavy defoliation of maple occurred in and around Peninsula State Park in Door County. Large numbers of cadavers were observed on trunks of trees indicating the presence of diseased larvae. This is the second year in a row that defoliation was observed.

European Fruit Lecanium - *Parthenolecanium corni* (Bouche)

Heavy infestations of this scale insect were reported on sugar maple twigs in Vilas and Price counties.

MISCELLANEOUS SPECIES

Frost - On June 20, the temperature dropped to 25°F in many locations throughout Wisconsin. This caused injury to several tree species including: black ash, balsam fir, red pine, northern pin oak, and spruce in northwestern Wisconsin, and red pine and northern pin oak in Oneida and Vilas counties, north-central Wisconsin. Severe damage to new shoots of white spruce and balsam fir Christmas trees occurred in Taylor, Langlade, Oneida, Lincoln and Oconto Counties. Injury to hardwoods often caused defoliation. Conifers affected by the frost had curled and crooked shoots that eventually died. In Vilas County, most of the injured red pine and oak did not reflush. In Eau Claire County, western Wisconsin, spruce, black walnut and several species of pine were injured. Seedling and sapling-size red pine were injured in Clark and Chippewa counties.

Balsam fir, white spruce and white pine Christmas trees in northern Wisconsin were also injured by the early summer frost. Severe loss of new growth occurred on hundreds of acres of Christmas trees affected by the frost.

Road Salt Injury

Red and white pine between Manitowish and Woodruff along Highway 57 and Woodruff to Rhinelander along Highway 47 showed symptoms of severe salt injury.

Gypsy Moth - *Lymantria dispar* (L.)

A spotty infestation exists in Marinette, Oconto, Brown, Door, Kewaunee, Manitowoc and Sheboygan counties. Although the total numbers of male moths caught in pheromone traps decreased from 1991 levels, the trap catches revealed concentrations that are probably infestation centers in these counties. Female moths, larvae, pupae, cast skins and/or egg masses were found in Marinette, Oconto, Brown, Door, Kewaunee, Manitowoc, Sheboygan, Fond du Lac, Milwaukee, Waukesha, Jefferson and Dane counties. Egg mass surveys revealed over 150 new egg masses.

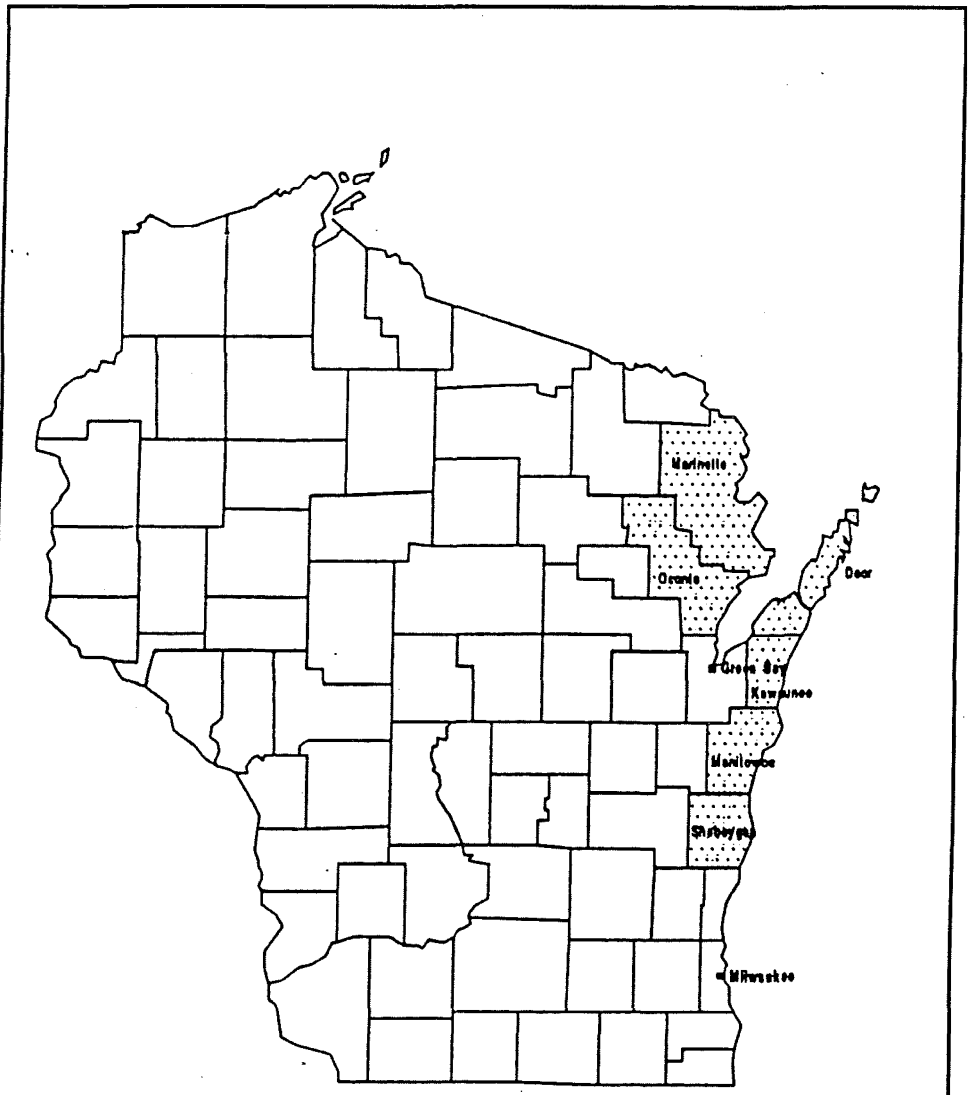

Figure 11. Counties where aerial spraying occurred to manage gypsy moth - 1992.

DNR continued to cooperate with Wisconsin Department of Agriculture (WDATCP), Trade and Consumer Protection, USDA Forest Service, USDA APHIS, and University of Wisconsin-Extension in a program to eradicate the infestation. Five locations in Marinette, Door and Kewaunee, Manitowoc and Sheboygan counties totaling 40,854 acres were sprayed three times with undiluted applications of the bacterial insecticide, *Bacillus thuringiensis* at a rate of 20 BIU (Figure 11).

Mass trapping was conducted in eight areas totaling 3,840 acres. Traps baited with + disparlure were placed at a rate of 9 per acre; a total of 32,407 traps were placed. A total of 2,416 male moths were caught in all the mass trapping areas. A total of 28 new egg masses were found, 21 in one concentrated area.

The table below lists the 1992 trap catches. The information was provided by WDATCP and is up to date as of November 19, 1992. Counties where gypsy moth egg masses, females, pupae, larvae or larval skins were observed are denoted by *.

County	Adult Males	County	Adult Males
Brown*	274	Marinette*	1,391
Calumet	4	Menominee	3
Columbia	5	Milwaukee*	135
Dane*	52	Oconto*	427
Dodge	1	Ozaukee*	75
Door*	3,474	Racine	20
Douglas	3	Rock	20
Fond du Lac*	11	Sauk	2
Green Lake	3	Shawano	2
Iowa	1	Sheboygan*	1,294
Jefferson*	64	Walworth	11
Juneau	1	Washington	8
Kenosha	12	Waukesha	23
Kewaunee*	642	Winnebago	30
Manitowoc*	1,961		
		State Total	9,949

Hickory Bark Beetle - Scolytus quadrispinosus

Pockets of bitternut hickories in Chippewa and Taylor have been killed by this inner bark borer. The attacked trees are also stressed by Armillaria root rot which often happens during and after a drought. Approximately 11 acres with a bitternut hickory component in the Chippewa County Forest (Sections 10,11, T31N, R8W) had extensive mortality of bitternut hickory from this insect.

White Grubs - *Phyllophaga* sp.

In Marinette County, (Section 16, T30N, R20E) high numbers of white grub larvae were observed in plantings of ash, maple, oak and walnut. These trees were being planted in alfalfa. In Portage county, (NWNW, Section 4, T21N, R7E) all larval stages were present at the time of planting red pine in sod on a 13 acre area. In Washburn County, heavy mortality occurred in a red pine planting due to white grub feeding. Heavy numbers of grubs were reported in new tree plantations in Door, Kewaunee and Manitowoc counties.

The adult stage of white grubs, the May and June beetles, were observed in large numbers at night in urban areas in Oconto, Marinette and Marathon counties. Progeny of these beetles could produce heavy damage to nearby young tree plantings in the next two years.

NURSERY

White Pine Seedling Root Rot - *Fusarium* sp.

The U.S. Forest Service, North Central Forest Experiment Station continued to conduct research on the cause of white pine root rot at the Wilson state forest tree nursery near Boscobel in southwestern Wisconsin. Several species of *Fusarium* were tested in the greenhouse to determine their pathogenicity. It is still unclear whether one species or a combination of several species are responsible for the root rot. Soil moisture potential and disease incidence were monitored during the growing season. There appears to be a relationship between soil moisture potential and disease incidence; both high and low soil moisture potential may encourage disease. Further work will be conducted in 1993 to test some of the hypotheses related to soil moisture.

Diplodia Shoot Blight and Canker - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

See Appendix A and red pine pests for additional reports on *Sphaeropsis*.

Diplodia shoot blight and canker has been a major pest of red pine at the Wilson state nursery in Boscobel, southwestern Wisconsin, since the early 1980s. Preventative treatment with the fungicide Benomyl has been effective in controlling Diplodia. An integrated pest management program including removal of infested windbreaks and a decrease in the use of Benomyl was initiated in 1990. Disease incidence of treated (Benomyl sprays) and untreated red pine seedlings has been monitored for three years in areas scattered throughout the nursery.

In 1990, 1991, and 1992, sections (approximately .6a of land between irrigation lines) considered at the highest risk for Diplodia because of their proximity to the last remaining infected windbreaks, were chosen for evaluation. Four plots, each 4' x 24', were established in each section and half the plots were treated and half untreated. The treated plots were sprayed with Benlate 50W on the regular nursery spray schedule (see results for schedule). Data on disease incidence were calculated from 6" x 4' plots placed at random in the treated and nontreated plots (Tables 1,2,3). Four of these data plots were established in each treatment and nontreatement plot. Treatments were applied for two years in Blocks A and C and for one year in Block B.

In general, disease incidence was higher in untreated plots in most sections of the nursery studied, yet disease incidence was low enough in the untreated areas to warrant consideration of reducing fungicidal sprays. Evaluation of the nursery will continue as different disease management programs are implemented. Past removal of the infected windbreaks will allow a reduction in fungicidal sprays for Diplodia shoot blight. Sprays may not be necessary for Block C, Sections 22-31. Block B, Sections 6-24 will probably only require spraying at the west end during the first year of seedling growth and Block A should be reevaluated.

Table 1. Incidence of Diplodia shoot blight in treated and untreated 1-0 and 2-0 red pine; treated and untreated plots were located at the east end of Block A, Wilson Nursery.

DISEASE INCIDENCE (%)[1]

SECTION	UNTREATED		TREATED[2]	
	1-0 1990	2-0 1991	1-0 1990	2-0 1991
A-3	8	4	N[3]	N
A-5	2	2	2	1
A-6	1	1	.2	1
A-7	1	5	.2	.2
A-8	4	2	1	.3
A-9	1	1	0	0

Table 2. Incidence of Diplodia shoot blight in treated and untreated 1-0 and 2-0 red pine; treated and untreated plots were located randomly throughout Block C, Wilson Nursery.

DISEASE INCIDENCE (%)[1]

SECTION	UNTREATED		TREATED[2]	
	1-0 1991	2-0 1992	1-0 1991	2-0 1992
C-22	1	2	0	0
C-23	3	3	1	0
C-24	.4	1	.2	0
C-25	1	1	1	2
C-27	2	4	0	0
C-28	2	1	0	1
C-29	1	N[3]	1	N
C-30	4	0	2	0

[1] Percent of seedlings with symptoms of Diplodia shoot blight. Data for each section calculated from 4, 6" x 4' plots placed at random in each 4' x 24' treated or untreated area = total of 16 data plots/section.

[2] Treatment = 1 lb. product Benlate 50W/a every other week; 1-0, early June - August; 2-0, mid-April - May.

[3] No plots in this location.

Table 3. Incidence of Diplodia shoot blight in treated and untreated 1-0 red pine; treated and untreated plots were located on the west end of Block B, Wilson Nursery.

DISEASE INCIDENCE (%)[1]

SECTION	UNTREATED 1-0 1992	TREATED[2] 1-0 1992
B-13	1	0
B-14	4	0
B-9	6	3
B-10	5	1

Red Pine Heat Injury

Small (2-3mm in height) vertical lesions were observed just above the soil line on 1-0 red pine seedlings at the Wilson state forest tree nursery in Boscobel, Wisconsin. The lesions were first observed in mid-August. Heat injury is the suspected cause of the lesions. Scattered light mortality was observed.

[1] Percent of seedlings with symptoms of Diplodia shoot blight. Data for each section calculated from 4, 6" x 4' plots placed at random in each 4' x 24' treated or untreated area = total of 16 data plots/section.

[2] Treatment = 1 lb. product Benlate 50W/a every other week; 1-0, early June - August; 2-0, mid-April - May.

OAK

Oak Wilt - *Ceratocystis fagacearum* (Bretz) Hunt

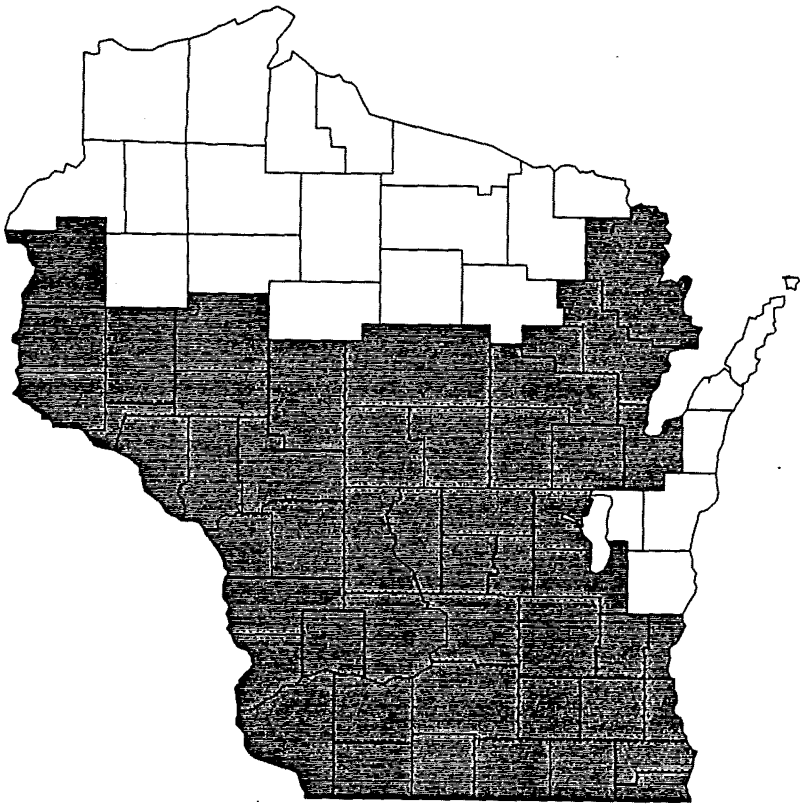

Figure 12. County location of Oak Wilt - 1992.

Oak wilt was not observed in any previously unreported counties (Figure 12). Surveys were concentrated in Marinette County, northeastern Wisconsin, where 8 oak wilt pockets were managed by severing the root grafts between diseased and healthy trees in 1989 and '90. Each of the oak wilt pockets was visited and surveyed for the presence of new infections. Overall, the root graft severing appears to have slowed or stopped the disease. One pocket had a new infection that should have been stopped by the trenching. The evaluation was clouded by the presence of mortality from the two-lined chestnut borer over the past 4 years. In some areas, two-lined chestnut borer mortality may have been diagnosed as oak wilt in 1989 and '90 which may have lead to trenching in areas where no disease was present. One new oak wilt infection center was observed along the Menominee River in Marinette County in 1992.

In Legend Lake, Menominee County, Northeastern Wisconsin, 8 new infection centers were observed. The Legend Lake Property Owners Association has supported an aggressive oak wilt control program including surveys, severing root grafts, and diseased tree removal. The same aggressive approach is planned for these new pockets.

Wilting oaks were frequently observed in western Waukesha County,

Two-lined Chestnut Borer - *Agrilus bilineatus* (Weber)

This secondary pest has contributed to the death of oaks in Marinette and Oconto counties that had been severely stressed as a result of drought and defoliation by forest tent caterpillar. In northwestern Wisconsin, the incidence of this insect decreased to endemic levels.

Oak Lacebug - *Corythucha arcuata*

This beautiful, elegant creature, which produced widespread bronzing in 1991 in northwestern Wisconsin, was rarely observed in 1992.

PINE

Armillaria Root Rot - *Armillaria mellea* (Vahl:Fr.) Kummer

Armillaria caused scattered mortality in an 11 acre red pine plantation in Brunet State Park in Chippewa County.

Common Pine Shoot Beetle - *Tomicus piniperda* (L.)

The common pine shoot beetle, *Tomicus piniperda*, native to Europe, was recently found attacking Scotch pine in the Cleveland, Ohio area. It has been found in Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York. This member of the bark beetle family was not discovered during a survey of 151 Wisconsin Scotch pine plantations by Wisconsin Department of Agriculture. A fact sheet on the beetle is available from the U.S. Forest Service or from DNR Forest Entomologists.

Diplodia Shoot Blight, Collar Rot and Canker: *Sphaeropsis sapinea* F(Fr.) Dyke and Sutton

See Appendix A for report.

Diplodia Canker and Shoot Blight - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

This disease is associated with rapid declining 48-year-old red pine on Georgia Pacific Lands in Adams County. In northwestern Wisconsin, despite the possible ideal conditions for infection of red pine due to snow and frost injury, this disease was largely inactive with no new outbreaks and only moderate spread in previously infected trees.

In Chippewa County, Diplodia was observed in a 5-year-old, 7-acre plantation (Section 34, T32N, R8W). Stone Pine yard trees in La Crosse County were also diagnosed with this disease.

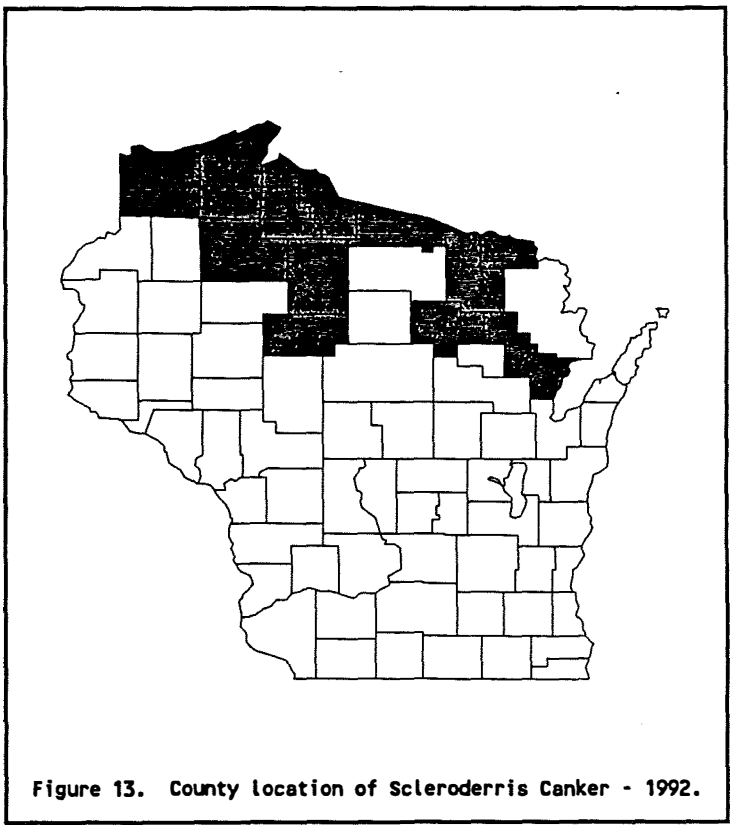

Figure 13. County location of Scleroderris Canker - 1992.

Scleroderris Canker - *Ascocalyx abietina* (Naumov) (Schlaepfer-Bernhard)

No new county locations were observed in 1992 (Figure 13).

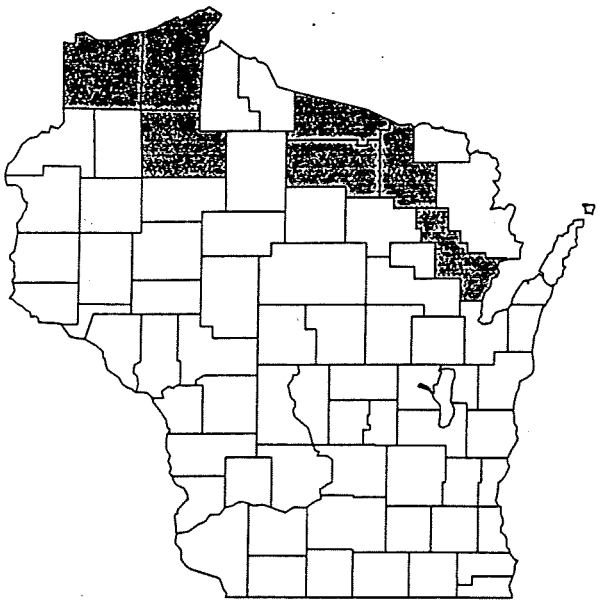

Figure 14. County location of red pine shoot blight - 1992.

Red Pine Shoot Blight - *Sirococcus conigenus*

No new county locations were observed in 1992 (Figure 14).

Decay of White Pine: *Phellinus pini* (Thore ex Fr.)

Phellinus pini has been present in white pine on the Menominee Indian Reservation for over 100 years. Currently, the reservation has several thousand acres of white pine 40-70 years old. Current management efforts are concentrating on releasing the white pine (primarily from aspen and oak) and pruning the dead branches to 17 feet. External signs such as swollen and bleeding knots were observed during pruning and a survey was conducted to determine if there was a relationship between the frequency of external signs and the severity of decay. Ten white pine on each of 3 habitat types were chosen for dissection. External signs of decay on each tree were noted then the trees were dissected and evaluated for decay. In summary, most external signs were found not to be good indicators of internal decay. Only fruiting bodies and large swollen knots with brown mycelia were always indicators of decay. These signs are most often located on the stem directly below dead branches. The site with the most decay had the most injury from white pine weevil and past logging activities; these injuries appeared to be the entry points for decay. A very low incidence of decay was observed on two of the sites where logging and white pine weevil injuries were less prevalent. Pruning white pine on the sites with low incidence of decay will slow the development of *Phellinus pini*; the pruning wounds will close and eliminate that avenue as a location for the fruiting body to form.

Pine Tussock Moth - *Dasychira pinicola* (Dyar)

Populations of this defoliator increased and defoliated 1,600 acres of jack pine in an area of Burnett county that had not displayed increasing populations in 1991 (Figure 15). Egg mass surveys indicate an extremely high population around this pocket. Severe defoliation on over 5,000 acres of jack pine in Burnett County is possible in 1993.

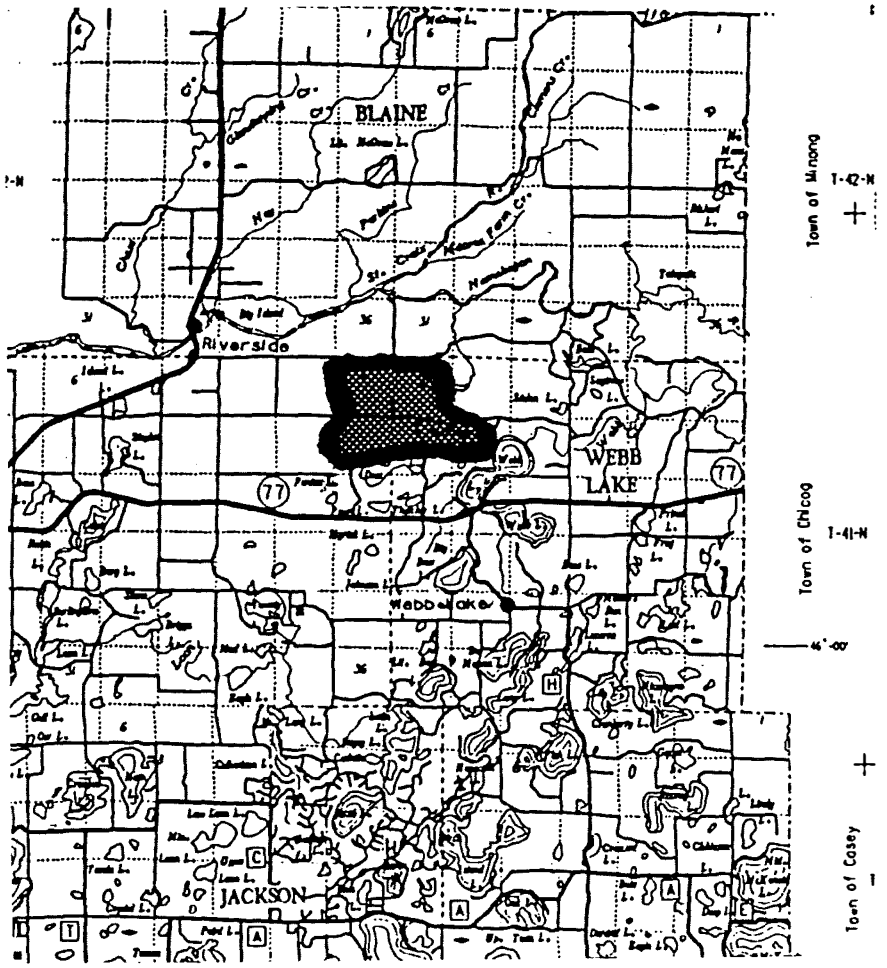

Figure 15. Area of defoliation of jack pine by the pine tussock moth - 1992.

No defoliation occurred in eastern Douglas county where increasing numbers of egg masses were observed in 1991. Egg mass surveys had indicated two potential areas of heavy defoliation in Solon Springs Township, Douglas County. Overall, egg mass numbers remained below the threshold levels over most of Douglas and Bayfield counties.

One heavy defoliation can cause significant tree mortality to mature jack pine. The outbreaks usually last three years and can spread to 40,000 or more acres. DNR foresters have silvicultural guidelines available to manage tussock moth-threatened jack pine stands.

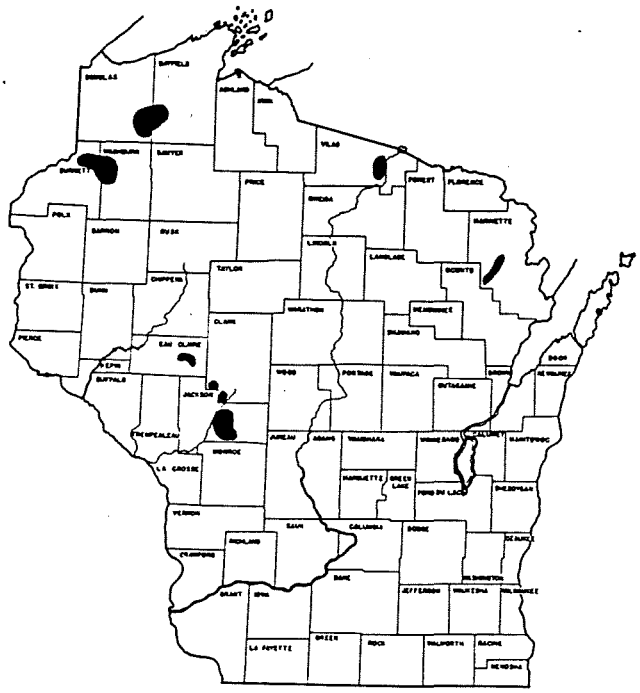

Figure 16. Area of defoliation of jack pine by the jack pine budworm - 1992.

Jack Pine Budworm - *Choristoneura pinus* (Rohwer) The outbreak in the northwestern counties, which began in 1991, exploded this year (Figure 16). Over 114,000 acres of jack pine were heavily defoliated in Douglas, Bayfield, Washburn and Burnett counties (Figures 17-20). Egg mass surveys indicate extremely high numbers of jack pine budworm. The area of defoliation may increase in 1993. The present defoliation is not expected to cause significant mortality except in Highland Township, but another year of heavy defoliation in the same stands could cause 10-15 percent mortality. In Highland Township, Douglas County, extremely severe feeding produced significant mortality and top dieback on several thousand acres of jack pine. Most of these stands are being harvested this winter. Moderate to heavy defoliation also occurred in Jackson, Juneau, Eau Claire, Marinette (1,650 acres), Vilas (2,960 acres) and Oconto counties (Figures 21-25). In Marinette County, 20 acres of 70-year-old jack pine were cut to release young jack pine and white pine. Jack pine budworm was causing severe top mortality. Evidence of budworm in the northern portion of the Monroe County Forest was observed on 35-40 year old jack pine (Sections 4,9,16, T19N, R3W).

DNR foresters have silvicultural guidelines available to manage budworm-prone jack pine stands.

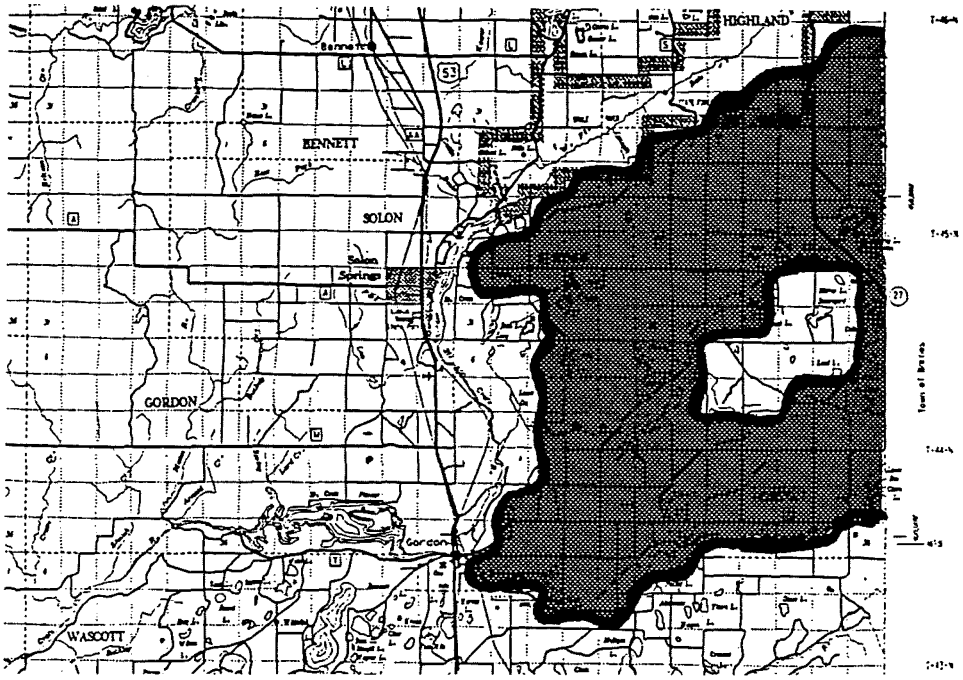

Figure 17 Area of defoliation of jack pine by the jack pine budworm in Douglas County - 1992.

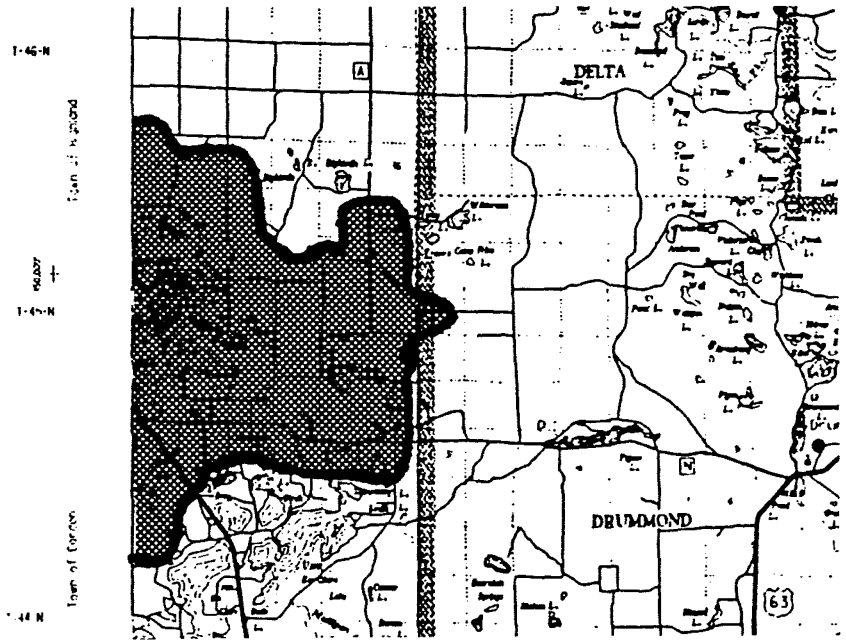

Figure 18 Area of defoliation of jack pine by the jack pine budworm in Bayfield County - 1992.

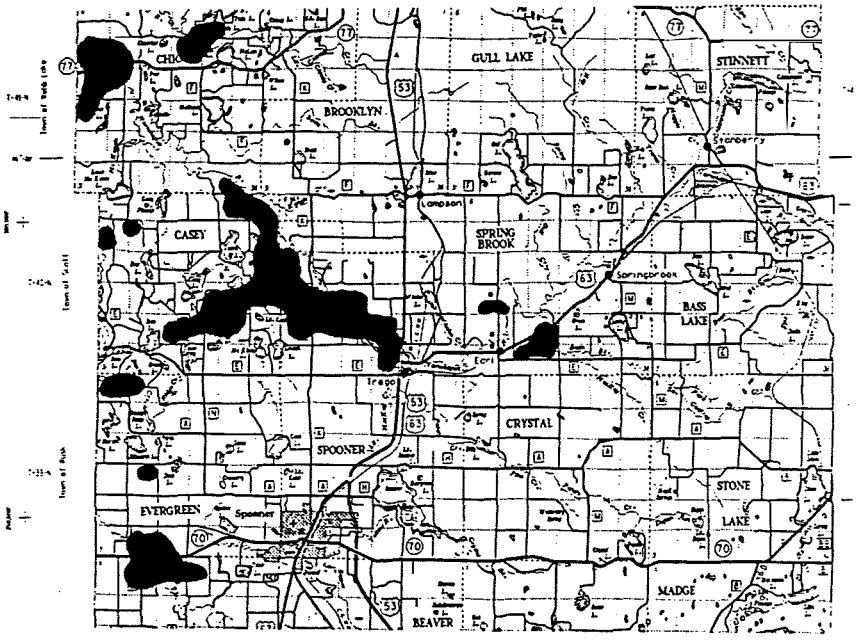

Figure 19 Area of defoliation of jack pine by the jack pine budworm in Washburn County - 1992.

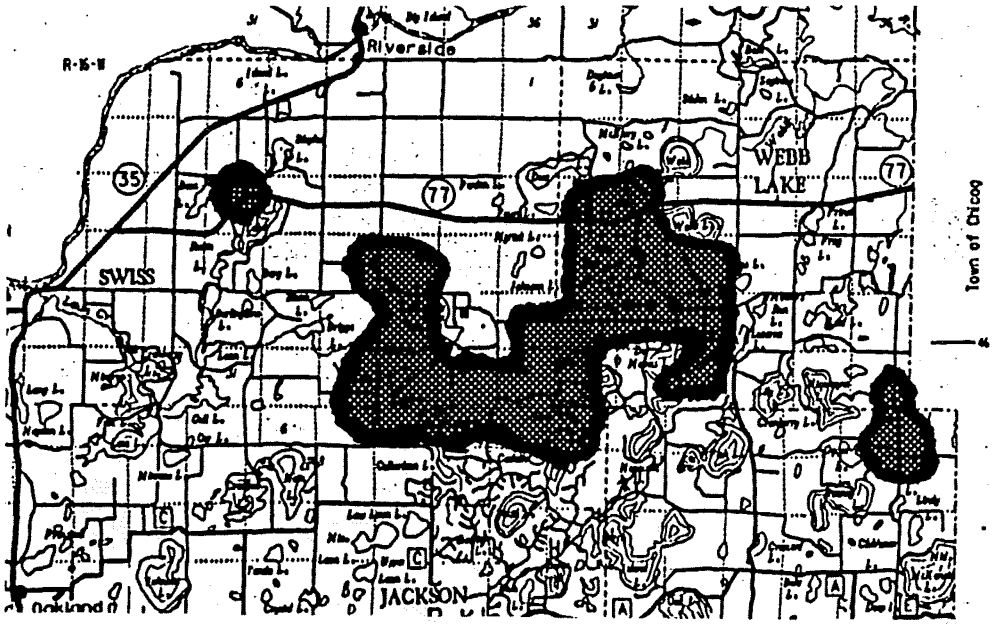

Figure 20 Area of defoliation of jack pine by the jack pine budworm in Burnette County - 1992.

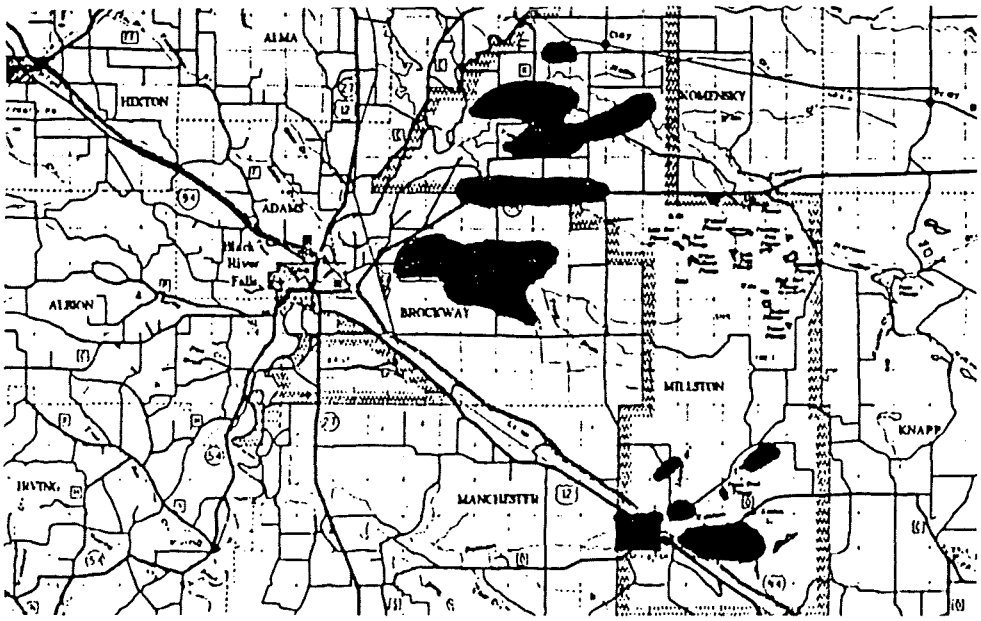

Figure 21 Area of defoliation of jack pine by the jack pine budworm in Jackson County - 1992.

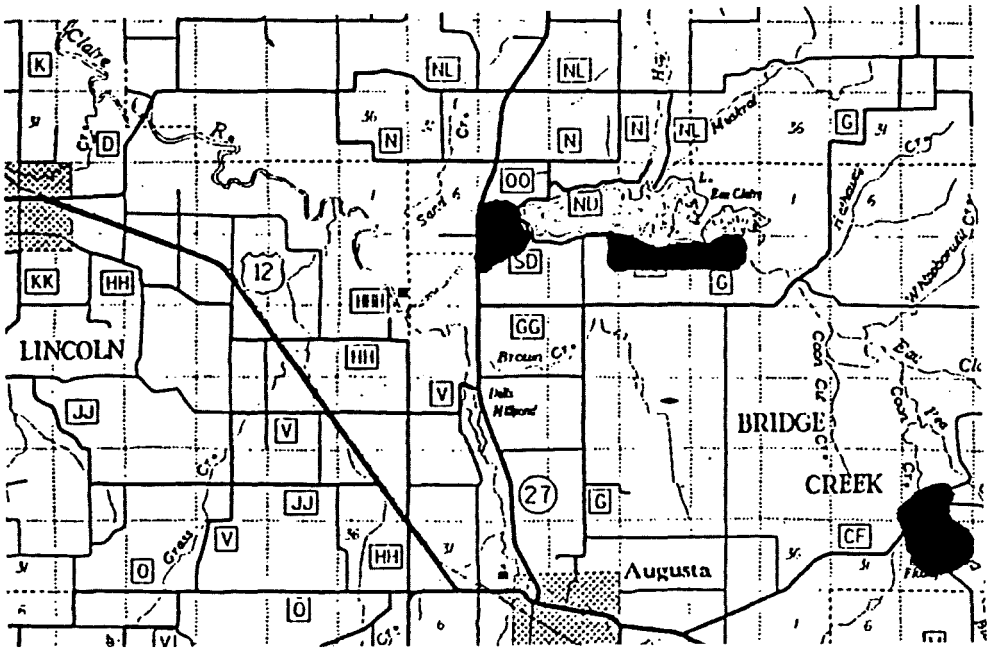

Figure 22 Area of defoliation of jack pine by the jack pine budworm in Eau Claire County - 1992.

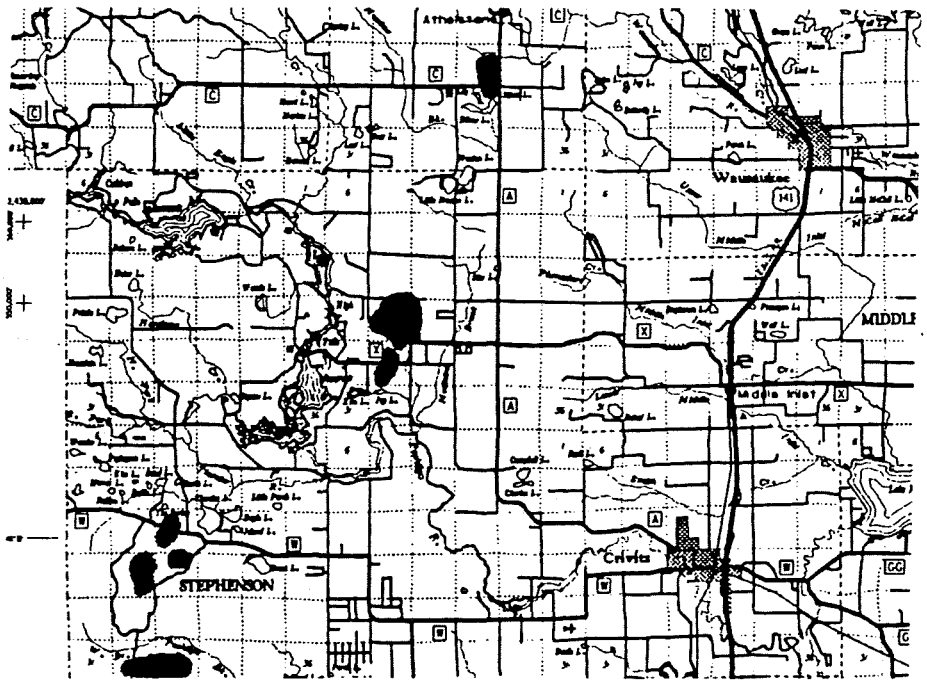

Figure 23 Area of defoliation of jack pine by the jack pine budworm in Marinette County - 1992.

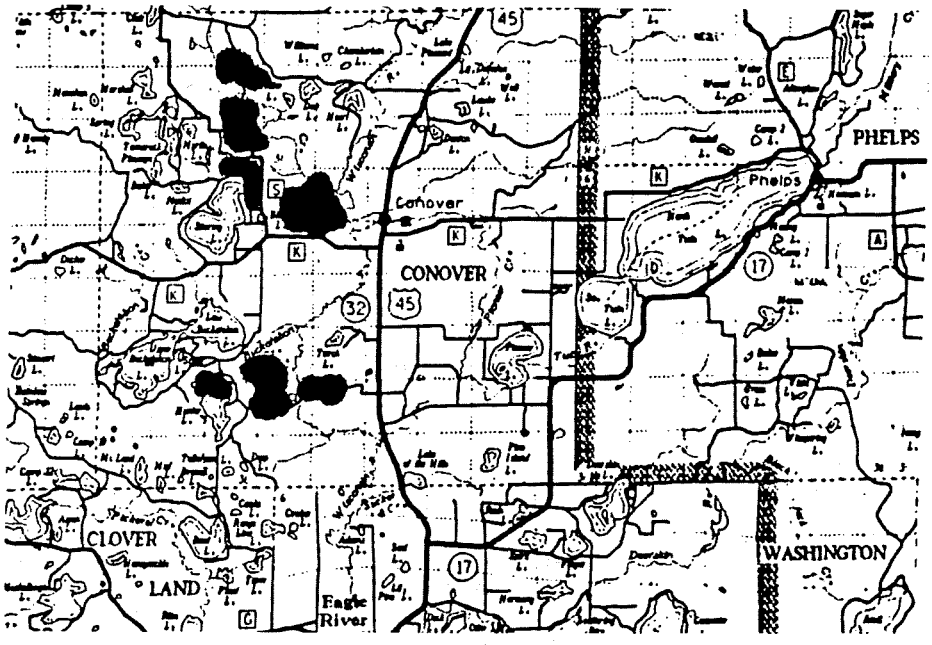

Figure 24 Area of defoliation of jack pine by the jack pine budworm in Vilas County - 1992.

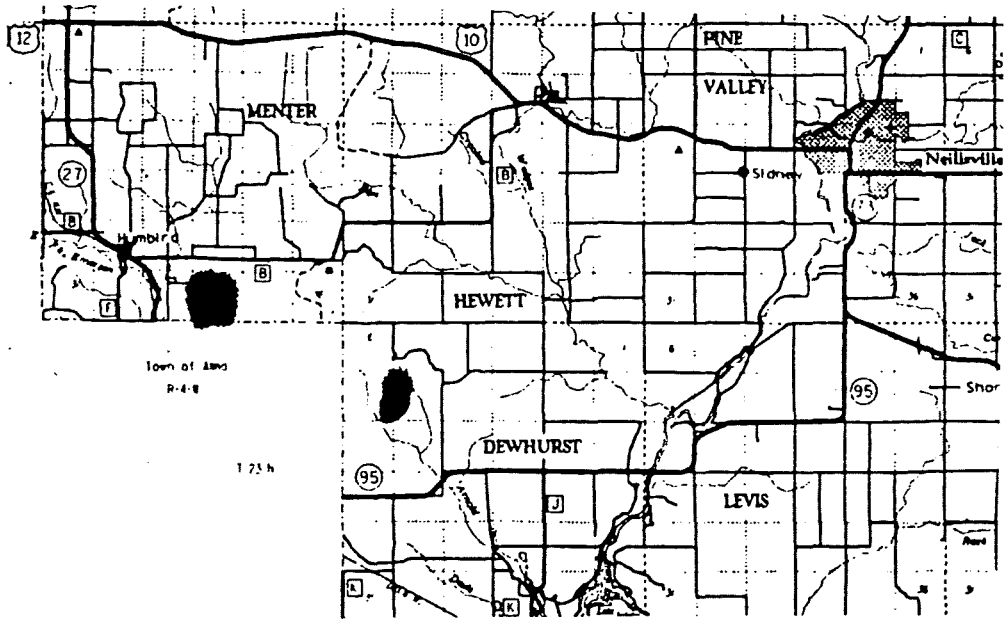

Figure 25 Area of defoliation of jack pine by the jack pine budworm in Clark County - 1992.

European Pine Sawfly - *Neodiprion sertifer* (Geoffroy)

Populations high in Ozaukee County caused moderate to heavy defoliation to Austrian and Scotch pines. Light to moderate defoliation of red and Scotch pine was observed in Columbia and Dane counties.

Red Pine Sawfly - *Neodiprion nanulus nanulus* Schedl

Populations decreased in northwestern Wisconsin from the 1991 levels.

Jack Pine Sawfly - *Neodiprion pratti banksianae* Rohwer

Populations of this insect decreased in northwestern Wisconsin from 1991 levels yet were still considered higher than normal.

A Jack Pine Sawfly - *Neodiprion maurus* Rohwer

Larvae of this rare pine sawfly were observed on jack pine understory in the Eau Claire County Forest (Section 20, T26N, R5W) in mid-July.

Redheaded Jack Pine Sawfly - *Neodiprion rugifrons* Middleton
The epidemic population in Juneau County declined to the point that only a few larvae were observed.

Introduced Pine Sawfly - *Diprion similis* (Hartig)

This insect was observed scattered throughout the northern portion of western Wisconsin including: Douglas, Dunn, Eau Claire, Clark and Jackson counties.

Populations decreased in northwestern Wisconsin from 1991 levels. Some mortality occurred in saplings and small pole-size white pine from the 1991 infestation.

Moderate defoliation to Christmas trees was observed in Green Lake County.

A low population of this insect was present on white pine in a nursery in Jackson County.

Red Pine Needle Midge - *Thecodiplosis piniresinosae* Kearby

This insect was observed in Burnett County (T40N, R15-17W; T30N, R16-17W) but in general was not widespread.

Jack Pine Pitch Midge - *Cecidomyia reeksi* Vockeroth

This twig damaging midge was reported for the first time in several years. Several heavy infestations were observed in edge and open grown jack pine trees in Vilas County.

Red Pine Shoot Moth - *Dioryctria resinosella* Mutuura

Numbers of attacked red pine shoots are very low along the Lower Wisconsin River in Sauk and Iowa counties.

Eastern Pine Shoot Borer - *Eucosma gloriola* Heinrich

Feeding injury was observed on jack pine terminal shoots in Washburn and Douglas counties.

Slight damage to scotch pine was observed in most of the Christmas tree plantations surveyed for the Pine Shoot Beetle.

Northern Pitch Twig Moth - *Petrova albocapitana* (Busck)

This obscure twig damaging caterpillar was observed doing light damage to sapling jack pine in Vilas County.

Saratoga Spittlebug - *Aphrophora saratogensis* (Fitch)

Injury to red pine was evident yet light in Wascott township, Douglas County. Injury was heavy in a red pine plantation in Springbrook township, Washburn County. In Lincoln County, mortality was heavy in 2 red pine plantations. Malathion was aerially applied to suppress a heavy adult population that threatened to severely damage 27 acres of red pine in Vilas County.

Phenological note: July 16 -
Population was 75% in 3rd instar.

Pine Spittlebug - *Aphrophora cribrata* (Walker)

This sapsucking insect was reported on white pine, white spruce and eastern hemlock in Jackson County (T23N, R4W).

Pine Tortoise Scale - *Toumeyella parvicornis* (Cockerell)

This insect is becoming more numerous on open grown jack pine in Marinette County. The increase in population may be a result of the 1988 and 1989 drought. Heavy infestations were noted in a jack pine seed orchard and jack pine plantations in Oconto County.

White Pine Aphid - *Cinara strobi* (Fitch)

Large numbers of colonies were observed on open grown jack pine in Vilas County.

Spotted Pine Aphid - *Eulachnus agilis* (Kaltenbach)

NEW WISCONSIN RECORD: This aphid was observed for the first time in Wisconsin in a 100-acre scotch pine Christmas tree plantation in Marathon County (S½, NW¼, Section 23, T30N, R7E) where heavy aphid feeding caused heavy damage to second and third year needles and lighter damage to current year needles. The damage caused noticeable chlorosis, browning and heavy needle drop rendering many trees unsalable for the 1992 season.

White Pine Weevil - *Pissodes strobi* (Peck)

Injury was observed on white pine and spruce in Eau Claire County, and on white pine in Crawford County. The majority of problems were reported from homeowners. Injury to terminals of white pine, Scotch pine and white spruce increased in north-central Wisconsin. Thirty-five percent of the terminals were killed in a 7-year-old Scotch pine plantation on the Northern Highland State Forest in Vilas County.

Pine Engraver - *Ips pini* (Say)

The cool, generally wet summer limited the success of this inner bark borer of pines. Only a few scattered pines that had been injured or weakened by diseases were killed.

Plains Pocket Gopher - *Geomys bursarius*

This animal caused injury to a 6-year-old red pine plantation in the Eau Claire County Forest (Section 1, T26N, R7W). Mortality was light.

Snow Damage

Thousands of acres of 2 to 5-year-old red pine plantations were heavily damaged by a snow storm occurring on October 31 and November 1 in Burnett, Washburn and Douglas counties. Mortality was less than 10 percent but almost half the trees suffered considerable damage.

Desiccation

Winds greater than 25 miles per hour and temperatures between 85-90°F on March 28 and 29, caused severe drying of foliage on several hundred acres of 8-year-old red pine in Wascott Township, Douglas County. Over half of the injured trees died. Needle scorch occurred over much of Douglas and Washburn counties on red pine.

SPRUCE

Yellowheaded Spruce Sawfly: *Pikonema alaskensis* (Rohwer)

This insect is becoming common where spruce is grown as an ornamental or open grown in roadsides and fields. Defoliation was heavy in Oneida and Vilas counties.

Spruce Spider Mite - *Oligonychus ununguis* (Jacobi)

A 60-acre Christmas tree plantation of 4 - 9 ft balsam fir, fraser fir and white spruce was severely damaged. Yellowing and needle drop rendered most of the trees unsalable for the 1992 season.

Yellowing/Reddening of Needles and Needle Loss - Unknown

Yellowing of spruce needles was observed in Pierce (Section 6, T26N, R17W) and St. Croix (Section 22, T31N, R19W; Section 14, T30N, R18W) counties. Reddening and needle loss in Clark County (Section 30, T29N, R2W) started on the new growth and at the tops of the trees.

APPENDIX A

Diplodia Collar Rot - *Sphaeropsis sapinea*

During the summer of 1992, Diplodia collar rot was identified on new plantings of red pine in Barron, Dunn, St. Croix, Eau Claire, Clark, Chippewa, and Pierce counties. Drought, the herbicide Oust, and Diplodia collar rot, have all been suggested as contributors to seedling mortality; other factors related to planting practices may also have contributed to mortality. Mortality appeared to have occurred early in the growing season as most dead seedlings had very little if any growth in 1992. A survey of red pine seedlings at Hayward State Nursery was conducted on November 10, 1992 to pursue the possibility of Diplodia collar rot originating from the nursery.

Methods

General observations were made of the red pine windbreaks, and the 3-0 and 2-0 seedlings throughout the nursery. Approximately 600 3-0 and 100 2-0 red pine seedlings were collected. The 3-0 seedlings were collected from areas of the nursery that had supplied the stock for some of the 1992 field plantings. All seedlings were examined for the presence of symptoms of Diplodia shoot blight and collar rot. Dead needles from the beds and fifty seedlings were dissected and placed into moist chambers to stimulate the formation of pycnidia (fruiting structure of *S. sapinea*). A subsample of seedlings were microscopically examined for the presence of pycnidia. Small shoots near the root collar of 50 seedlings were dissected and placed onto an agar medium in an attempt to isolate the pathogen. The small shoots near the root collar were targeted because pycnidia were almost always observed on or close to these shoots on infected seedlings observed in the field plantings.

Results

Only an occasional infected shoot was observed on the red pine windbreaks and seedlings in the nursery. Symptoms of Diplodia shoot blight and collar rot were rare on the 700 seedlings examined in the laboratory. No pycnidia were observed on the dead needles or 50 seedlings dissected and placed into the moist chamber. Of the 50 small shoots dissected and placed onto agar medium, 1 produced a culture of *S. sapinea*. Several saprophytic fungi (fungi living on dying tissue) were isolated from these small shoots. Microscopic examination showed the presence of pycnidia on some of the small shoots near the root collar yet the overall disease incidence appears to be very low.

Conclusions

The incidence of symptoms of Diplodia shoot blight and collar rot was very low in the seedlings examined. The majority of small shoots near the root collar appear to currently be infested with saprophytes, not pathogens. The overall level of disease appears to be very low at Hayward Nursery and no disease management program is recommended at this time. Further sampling and field observations will be conducted in the spring of 1993. Research on the relationship between drought stress and disease will also be conducted in 1993.